

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (currently amended) A method for improving a thermal barrier coating comprising:

providing a substrate;

providing a bond coat composed substantially only of nanocrystalline MCrAlY, where M stands for either Co, Ni and/or Fe, using a thermal spray process onto a metallic substrate, ~~a nanocrystalline, nano-composite bond coat on the substrate;~~ and

providing a ceramic top coat on the nanocrystalline ~~nanstructured nano-composite bond coat.~~

2. – 10. (cancelled)

11. (currently amended) The method of claim 1 where providing the nanocrystalline, nano-composite bond coat on the substrate comprises providing a ~~the nanocrystalline alumina coating by comprises~~ cryomilling an alumina powder to achieve nanocrystalline grain sizes and disposing the cryomilled nanostructured alumina composite coating on a the bond coat on the substrate.

12. (original) The method of claim 11 where disposing the alumina powder on the bond coat comprises plasma spraying the nanocrystalline alumina powder onto the bond coat in the presence of oxygen.

13. (currently amended) A thermal barrier coating comprising:

a substrate;

a bond coat substantially only composed of nanocrystalline MCrAlY, where M stands for either Co, Ni and/or Fe, using a high velocity oxy fuel (HVOF) thermal spray process or low pressure plasma (LPPS) spray process onto a metallic substrate a nanocrystalline, nano-composite bond coat on the substrate; and

a ceramic top coat on the nanostructured, nano-composite bond coat.

14. – 24. (cancelled)

25. (currently amended) A method for improving a MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

providing a MCrAlY bond coat on a substrate; and

providing a nanocrystalline nano-composite coating on the MCrAlY bond coat with a nanostructured nano-composite-bond coat only by refining the microstructure of the MCrAlY powder to nanocrystalline grain size.

26. (cancelled)

27. (original) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder during which the microstructure of the MCrAlY powder is refined to nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

28. (original) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size during cryomilling through the introduction of  $\text{Al}_2\text{O}_3$  particles during cryomilling.

29. (original) The method of claim 28 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size during cryomilling comprises introducing nano alumina particles during cryomilling.

30. (currently amended) The method of claim 28 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size achieved after cryomilling comprises introducing nano alumina whiskers during cryomilling.

31. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a MCrAlY bond coat on a substrate; and

a nanostructured nano-composite bond coat with nanocrystalline size MCrAlY grains on the MCrAlY bond coat on a substrate.

32. (cancelled)

33. (original) The thermal barrier coating of claim 31 where the nanocrystalline size MCrAlY grains are formed by cryomilling the MCrAlY powder during which the microstructure of the MCrAlY powder is refined to nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

34. (original) The thermal barrier coating of claim 31 where the powder nanocrystalline size MCrAlY grains are formed by cryomilling the MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size after cryomilling through the introduction of  $\text{Al}_2\text{O}_3$  particles during cryomilling.

35. (original) The thermal barrier coating of claim 34 where the nanocrystalline size MCrAlY grains formed after cryomilling arise from nano alumina particles introduced during cryomilling.

36. (currently amended) The thermal barrier coating of claim 34 where the nanocrystalline size MCrAlY grains formed achieved after cryomilling arise from nano alumina whiskers introduced during cryomilling.

37. (new) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;  
a fully nanocrystalline MCrAlY bond coat on the substrate; and  
a ceramic top coat on the fully nanocrystalline bond coat.

38. (new) The MCrAlY thermal barrier coating of claim 37 further comprising an  $\text{Al}_2\text{O}_3$  nanoparticle additive disposed throughout the fully nanocrystalline MCrAlY bond coat which  $\text{Al}_2\text{O}_3$  nanoparticle additive was added during cryomilling of the MCrAlY powder.

39. (new) The MCrAlY thermal barrier coating of claim 38 where the  $\text{Al}_2\text{O}_3$  nanoparticle additive was introduced as  $\text{Al}_2\text{O}_3$  powder added during cryomilling of the MCrAlY powder.

40. (new) The MCrAlY thermal barrier coating of claim 38 where the  $\text{Al}_2\text{O}_3$  nanoparticle additive was introduced as  $\text{Al}_2\text{O}_3$  whiskers added during cryomilling of the MCrAlY powder.

41. (new) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;  
a bond coat on the substrate composed of more than 30% by volume nanocrystalline MCrAlY; and  
a ceramic top coat on the bond coat.

42. (new) The MCrAlY thermal barrier coating of claim 41 further comprising an  $\text{Al}_2\text{O}_3$  nanoparticle additive disposed throughout the fully nanocrystalline MCrAlY bond coat which  $\text{Al}_2\text{O}_3$  nanoparticle additive was added during cryomilling of the MCrAlY powder.

43. (new) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;

a fully nanocrystalline MCrAlY bond coat on the substrate;

a ceramic top coat on the fully nanocrystalline bond coat; and

an  $\text{Al}_2\text{O}_3$  nanoparticle additive disposed throughout the fully nanocrystalline MCrAlY bond coat which  $\text{Al}_2\text{O}_3$  nanoparticle additive was added during cryomilling of the MCrAlY powder.

44. (new) The method of claim 1 where providing a bond coat composed substantially only of nanocrystalline MCrAlY comprises cryomilling a MCrAlY powder at low speed below 450 rpm.

45. (new) The method of claim 44 where cryomilling a MCrAlY powder at low speed comprises cryomilling with a model 1-S attritor or equivalent.